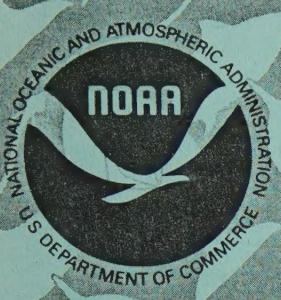


84-33



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SEPTEMBER 1984

DOCUMENTATION OF THE TIME SEQUENTIAL
FILE CREATED FROM THE OBSERVER DATA
BASES FOR ANALYZING OF RELATIVE ABUNDANCES

BY
TOM POLACHECK

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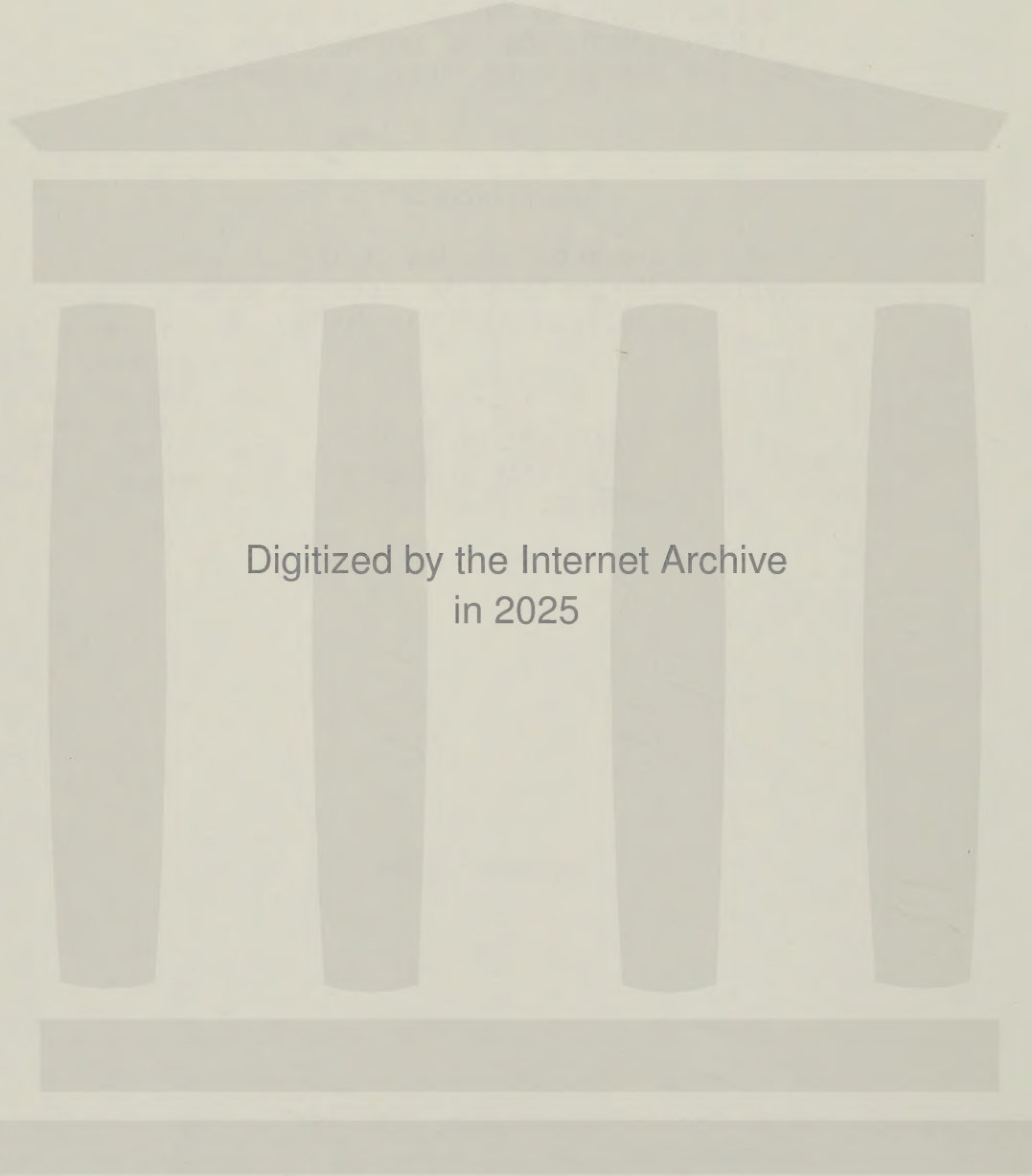
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CONTENTS

	Page
OVERVIEW.....	2
DATA EXTRACTION.....	3
COMMON FORMAT.....	6
COMBINE AND SORT.....	6
INTERPOLATING POSITIONS.....	7
CROSSINGS OF 1° LINES.....	9
ERROR CHECKS.....	10
APPENDIX.....	21

LIST OF TABLES

Table	Page
1 Description of the format and sources of data elements for a TA file.....	11-14
2 List of data elements for which missing values are indicated by a -1.....	15

LIST OF FIGURES

Figures	Page
1 Diagram of the major steps in creating the TA files from the observer data bases.....	17
2 Flow chart of the programs and intermediate files created by the M-1 process. Boxes indicate files and elipse indicate programs.....	18
3 Diagrams indicating how the value of MAXD was calculated.....	19
4 The frequency distribution of the value of MAXD for all interpolated positions estimated by the M-1 process.....	20

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Data collected by National Marine Fisheries Service scientific observers aboard tuna purse seiner in eastern tropical Pacific are stored within the data management system at the Southwest Fisheries Center (SWFC) in seven distinct data bases each representing one basic type of information. Cross referencing the information in these data bases can be an arduous task. In order to use the information contained in these data bases for developing measures of relative abundance, it became necessary to create a time sequential or "stream of conscious" data file which contained much of the information in six of these seven data bases. The purpose of this report is to document the structure of this time sequential data file and the process that created it. The process which creates this time sequential file also interpolate positions for all records and makes a number of cross data base error checks. These time sequential files (which will be referred to as TA files) may be useful for a number of different analysis in addition to the studies on relative abundance for which they were initially created and are therefore being stored on magnetic tape at the SWFC.

OVERVIEW

The creation of these TA files involved the following six major tasks:

1. extraction of data files from NMFS data bases,
2. creation of a common format for these extracted files,
3. combining and sorting time sequentially these extracted files,
4. interpolating positions for records without positional information,
5. estimating the time and position of every crossing of a 1° line of latitude and longitude by a vessel and
6. checks for possible logical and positional errors within the data

These six tasks were accomplished in two stages. The first stage was the extraction from the data bases of four basic file types. The second stage was the execution of a number of Fortran computer programs which have collectively been named the M-1 process. Figure 1 diagrams the major steps in creating the TA files from the data bases while Figure 2 is a flow chart of the programs and the intermediate files for the M-1 process. Table 1 gives a list of the data elements and the format of the TA files created by the M-1 process.

Separate extraction programs had to be written covering different time periods of the data due to minor differences in the information which was collected and stored in different years. These extraction programs were originally written by Joe Corso for use on the Infonet computing system and

were subsequently modified for use on the VAX computer at Scripps Institution of Oceanography by Phil Tarantino and Celia Jacobs. The programs comprising the M-1 process were written by the author except for the program DREC1 which was written by Jay Walker and later modified by Phil Tarantino. Listings of all these programs are available at the Southwest Fisheries Center.

The extractions from the data bases into the four basic data files was done on a by year basis (i.e. a years data was contained in one file) while the execution of the M-1 process was conducted on a by cruise basis. The creation of the job command streams necessary for splitting the extracted data files into by cruise files, executing the programs comprising the M-1 process and combining the individual TA files for each cruise into annual files was done by Susan Boyer.

DATA EXTRACTION

The data extraction process resulted in the creation of four data files which are referred to as the extended marine mammal effort file (ME), the extended marine mammal sighting file (MS), the extended nonporpoise set log file (NP) and the extended revised vessel activity file (VA). The first two fields of each of these files consisted of an identification label (i.e. ME, MS, NP or VA) so that the source of any record could later be identified when the files are subsequently combined. The next 33 fields contains 13 data elements from the cruise specification data base (i.e. data elements 2-14 in Table 1). The same value for all 13 data elements are found for any record associated with a particular cruise. Seven of these data elements can potentially change during the course of a cruise although they rarely do. To handle this situation, the following two conventions were adopted: 1) the observer number of the observer who spent the longest time on board is used

for this data element and the number of observer trips is the number associated with that observer number; 2) if the number of speed boats, the gear type, the length of the net, the depth of the net or the presence of a helicopter changed during the course of a trip, the value assigned to those elements which change is a -2 except for helicopter element which was assigned a value of 3. In addition, Code Table 1 in Appendix I was used to code the element corresponding to trip completed.

The ME files are constructed by creating a record for the beginning of every leg of effort within an effort series. The data elements that are extracted in addition to the elements from the cruise specification data base are a subset of the elements in the Marine Mammal Effort Data Base (Table 1). For detailed definition of each data element, one should refer to the observer field manual for the year in question. The only change made to any of these elements is for end leg code. Subsequent processing on this file results in the creation of an additional record for the end of a series. In this situation the data element end leg code was given a value of 8 (see Code Table 2).

The MS file is constructed by creating a record for every sighting in the Marine Mammal Sighting Data Base. The data elements extracted for this file are a subset of the elements in the Marine Mammal Sighting Data Base. In addition every sighting record is checked to see if the data element set number is not equal to zero. In these cases, a subset of the elements from the Set Log-Data Bases is also extracted (Table 1). This procedure does not guarantee that every set on a marine mammal will be associated with a sighting record as a few errors in the Marine Mammal Sighting Data Base may exist such that the set number is missing. In such situations, a warning message results in latter processing in M-1. Detailed definition of each data element is

again contained in the appropriate year's observer field manual. Note that the data elements escape before rings up, number escape before rings up and species code escaping before rings up for the years prior to 1979 refers to total escapement from the net and not just escapement before rings up. Also note that if no position is found in Marine Mammal Sighting Data Base and the sighting resulted in a set the position in the Set Log Data Base is used.

The NP file consists of a single record for every set not involving a marine mammal. The data elements in this file contain a subset of the information record on the schoolfish set log forms in the observer manual (Table 1) in addition to the cruise specification data elements.

The VA file contains a record for time entry in the Vessel Activity Data Base. The data elements are a simple subset of the elements in this data base and the elements from the cruise specification data base. In addition, the information contained in the elements searching yes/no chase/set yes/no; inactive yes/no; and inactive code is transformed into a single data element called mode. Code Table 3 (Appendix I) contains definitions for all values used for this element.

The data element time of activity is meant to refer to the time at which the activity or event referred to by a record was initiated. For the ME file this corresponds to the element time start leg (except for the subsequently added records indicating the end of a series, in which case the time is the end leg code time). For the MS file, time of activity corresponds to time of sighting cue. If the information for this data element is missing then time of marine mammal sighted is used. If this datum is also missing and the sighting resulted in a set, the time chase began is used. For the NP file, time of activity corresponds to time net let go and for the VA file it corresponds to time mode change.

Data elements with missing values were handled in two ways depending upon whether non-missing values can take on the value of zero. For elements in which zero was not a logical possibility, the element was left blank. (Note because Fortran does not distinguish blanks and zeros in numerical formatting some of these values are converted to zero by the M-1 process.) For data elements in which zero is a logically possible value, a value of -1 is used to indicate missing information. Table 2 lists those elements for which a -1 is used as the missing value code. Note that for any data element involving time, zeros are still used as the value for missing time, since midnight if it occurs in the data bases is coded as 23:59.

COMMON FORMAT

The task of arranging the data in the different files into a common format consisted of insuring that data elements with common names in the different extracted files (e.g. Beaufort, set number, series, leg, etc.) had the same starting position and field widths. In hind sight, this task could have easily been incorporated into the data extraction process.

COMBINE AND SORT

Combining and sorting the extracted files is accomplished with the VAX system append and sort routines. A stable sort is done using the data elements year, month, day, time of record (hour), time of record (minute) as the sort key. The stable sort means that records from different files but with the same time and date will always be sorted in the same relative order. The order is first ME, second MS, third NP and fourth VA. The reason for doing this is to be able to associate the proper sighting with a chase mode record from the VA file and to be able to check that for all set numbers

in the MS or NP files that there exist a corresponding set record in the VA file (and vice versa).

INTERPOLATING POSITIONS

An attempt was made to associate an approximate position with every record in the TA files. Positions are supposed to be recorded by the observer every time a sighting or a set is made and at least once during every marine mammal effort series. In addition the course and speed is recorded during all legs within an effort series and the speed is recorded for all searching records in the vessel activity data base. The assigning of positions is a two-step process. The program DREC1 determine a position for every leg of effort within a series of effort in which at least one position was recorded. It does this by dead reckoning from known positions both forwards and backwards using the course and speed data associated with each leg. For series with more than a single position, the program dead reckons forward from the last known position.

The second step for assigning a position is accomplished by the program DRFMR. The underlying assumption of the program is that the course steered between any two known or dead reckoned positions was a straight line. Positions were then assigned to records between two known positions by prorating the total distance between the two known positions according to the implied distance travel (i.e. elapsed time x speed) between any two records relative to the total implied distance traveled between the two known positions. An expression for this procedure is:

$$D_i = D_t \times \frac{\sum_{j=0}^i T_j S_j}{\sum_{j=0} T_j S_j}$$

where

D_i = the distance traveled along the line for the i^{th} record since a known position,

D_t = the distance between the two known positions,

T_j = the elapsed time during the j^{th} record,

S_j = the speed during the j^{th} record and

n = the number of records between two known positions.

The series of D_i 's for all records between two known positions combined with the assumption that the course between any two positions was a straight line uniquely determines a position for every record between two known positions.

For inactive records from the VA file, the speed was assumed to be zero except when the boat was running. When the boat was running, the speed was assumed equal to the model speed of the vessel when it was searching. The speed during chase and set records was also assumed equal to zero.

The positions assigned to each record using this procedure can only be considered approximate but should allow the searching effort of the vessel to be classified by general area. In order to get an indication of the error encompassed in this interpolation procedure, an estimate of maximum possible distance that the vessel could have been from an interpolated position is calculated using the implied distance traveled based on elapsed time and

speed. The estimate of this maximum possible distance is stored as the last data element in the TA file and will be referred to as MAXD. The calculation of the value for MAXD uses the implied distance traveled from the last known or dead reckoned position to the position in question (E_b) and the implied distance traveled from position in question to the next known or dead reckoned position (E_a). The value of MAXD is then the distance from the vertex of the triangle formed by these two implied distances and the actual distance between the two known positions (Figure 3a). In those situations in which one of the implied distances traveled is greater than the sum of the other implied distance traveled plus the distance between the two known positions, MAXD was calculated as shown in Figure 3b. If the sum of the implied distance traveled before and after a record was insufficient to cover the actual distance between the two known positions, then MAXD is given a value of -1 (Figure 3c). (Program PCHECK latter checks whether the implied speed of travel between all positions in the TA file is greater than 18 knots.)

Figure 4 presents histogram for the value of MAXD for all positions created by the above interpolation procedure for the TA files for years 1977 to 1980.

CROSSINGS OF 1° LINES

In order to be able to stratify the searching effort by geographic areas, it is necessary to estimate whenever a vessel crosses into a different area. By including an estimate of whenever a vessel crossed a 1° line of latitude or longitude in the TA file, it is then possible to stratify the data by any geographic stratification with a resolution of 1 degree. The programs MAEE and FMRDC accomplished this task. The first program estimates every crossing by the vessel of a 1° line when the observer is on effort and the second

program estimates every crossing when the observer is not on effort. Both programs result in the insertion of a new data record for every crossing of a 1° line. The inserted records have the same data in them as either the preceding effort or vessel activity record except for the data elements time of activity, position and source of position. Source of position for these inserted records is always given a value of 9.

Both of the above programs check sequentially every pair of records in the input file to the program to see if they are in the same 1° square. If they are not, the position of every crossing of a 1° line is estimated by assuming that the course between the pair of records was a straight line. The time at which the crossing occurred is estimated by calculating the elapsed time between the pair of records in different 1° squares and assuming that the time spent in each square is proportional to the distance traveled in each square if the vessel had steered a straight course.

ERROR CHECKS

Many of the programs in the M-1 process check the data for possible logical or positional errors in the data. Logical errors occur when the data extracted from one data base is incompatible with data from another (e.g. a sighting record with a set number but no corresponding set number in the vessel activity data base) or when the data within a data base is inconsistent (e.g. no end indicated for a series of effort). Positional errors can be detected when the time and distance between two records implies that a vessel's speed was improbably high. The program PCHECK performs checks for this type of positional error and prints out a warning message whenever the implied speed between a pair of records exceeds 18 knots.

Table 1. Description of the format and sources of data elements for a TA file.

Data element name	Starting position	Field width	Source of Data ¹
File ID	1	2	Data extraction program (see text)
Cruise number	3	3	CSDB
Vessel code	6	4	CSDB
Year built	10	2	CSDB
Vessel capacity	12	4	CSDB
Observer number	16	3	CSDB - see text for handling of multiple observers
Number of speed boats	19	2	CSDB
Helicopter ²	21	1	CSDB
Trip completed	22	1	CSDB; see Code Table 1
Number of observer trips	23	2	CSDB - see text for handling of multiple observer
Cruise type	25	2	CSDB
Gear type	27	2	CSDB
Net length	29	3	CSDB
Net depth	32	3	CSDB
Set number	35	3	MSDB, MEDB, VADB or SLDB
Year	38	2	Source of record
Month	40	2	Source of record
Day	42	2	Source of record
Sighting number	44	3	MSDB, MEDB
Degree latitude	47	2	
Minute latitude	49	2	
North/south	51	1	See text and data element source of position (starting position)
Degree longitude	52	3	
Minute longitude	55	2	
East/west	57	1	
Beaufort ⁵	58	2	MEDB, VADB, MSDB
Set type	60	2	SLDB, VADB
Effort series	62	2	MEDB, MSDB
Effort leg	64	2	MEDB, MSDB
Time of record (hour)	66	2	
			See text
Time of record (minute)	68	2	
Sighting cue	70	1	MSDB
Initial sighting cue	71	1	MSDB

Table 1. Continued

Data element name	Starting position	Field width	Source of Data ¹
Bearing of cue	72	3	MSDB
Distance of cue	75	4	MSDB
Surface temperature	79	4	MEDB, VADB, MSDB
Source of position	83	1	See text and code Table 3 (Appendix II)
Birds (yes/no) ²	84	1	MSDB, SLDB
Time marine ²			
Mammals sighted (hour)	85	2	MSDB
Time marine mammals sighted (minutes)	87	2	MSDB
Time chase began (hour)	89	2	SLDB
Time chase began (minutes)	91	2	SLDB
Number of speed boats used	93	2	SLDB
Time net let go (hour)	95	2	SLDB
Time net let go (minutes)	97	2	SLDB
Evaded set (yes/no)	99	1	SLDB
Total number evaded set	100	4	SLDB
Species evaded set	104	2	SLDB
Escape before rings up ³	106	1	SLDB
Number escape before rings up ³	107	4	SLDB
Species escape before rings up ³	111	2	SLDB
Fish lost during back-down (yes/no)	113	1	SLDB
Tons lost during back-down	114	3	SLDB
Time set ends (hour)	117	2	SLDB
Time set ends (minutes)	119	2	SLDB
Tons yellowfin	121	3	SLDB
Tons skipjack	124	3	SLDB
Tons other	127	3	SLDB
Other species code	130	2	SLDB
Set aborted (yes/no)	132	1	
Net dumped (yes/no)	133	1	SLDB
Malfunction ² delay set (yes/no)	134	1	SLDB
Malfunction delay set (minutes)	135	3	SLDB

Table 1. Continued

Data element name	Starting position	Field width	Source of Data ¹
Crew school size estimates:			
Mean	138	4	MSDB
High	142	4	MSDB
Low	146	4	MSDB
Observer school size estimates:			
Best	150	4	MSDB
High	154	4	MSDB
Low	158	4	MSDB
Species One:			
Crew: Percent	162	3	MSDB
Species code	165	2	MSDB
Observer: Percent	167	3	MSDB
Species code	170	2	MSDB
Species Two:			
Crew: Percent	172	3	MSDB
Species code	175	2	MSDB
Observer: Percent	177	3	MSDB
Species code	180	2	MSDB
Species Three:			
Crew: Percent	182	3	MSDB
Species code	185	2	MSDB
Observer: Percent	187	3	MSDB
Species code	190	2	MSDB
Species Four:			
Crew: Percent	192	3	MSDB
Species code	195	2	MSDB
Observer: Percent	197	3	MSDB
Species code	200	2	MSDB
Species Five: ⁴			
Crew: Percent	202	3	MSDB
Species code	205	2	MSDB
Observer: Percent	207	3	MSDB
Species code	210	2	MSDB
Reliability code	212	1	MSDB
Bearing of vessel	213	3	MEDB
Speed of vessel ⁷	216	4	MEDB
Fog/rain ⁶	220	1	VADB, MEDB
Helicopter (up/down)	221	1	MEDB

Table 1. Continued

Data element name	Starting position	Field width	Source of Data ¹
Number of binoculars	222	2	VADB
End leg code of effort	224	1	MEDB
End time leg of effort (hour)	225	2	MEDB
End time leg of effort (minutes)	227	2	MEDB
Wind speed tow line in	229	2	SLDB
Elapsed distance to next record	231	5	Calculated by program PCHECK
Elapsed time till next record (hour)	236	2	Calculated by program PCHECK
Elapsed time till next record (minutes)	238	2	Calculated by program PCHECK
Mode	240	2	See Code Table-Appendix I and text
MAXD	242	4	Calculated by program DRFMR (see text)

¹Refers to the actual SWFC data base from which the information for that data element was obtained unless otherwise noted. Multiple data base entires occur because the same type of information is stored in more than one data base. For any record, there is only one possible data base source which should be obvious from the file I.D. elements at the beginning of the record. The following abbreviations are used for data base names:

- CSDB - Cruise specification data base
- MEDB - Marine mammal effort data base
- MSDB - Marine mammal sighting data base
- SLDB - Set log data base
- VADB - Vessel activity data base

²Not present in data bases before 1979. These fields are left blank in the TA files for earlier years.

³Data elements referring to escape before rings up refer to total escapent in the data before 1979.

⁴Data elements for species five are not present in data bases past 1978. These fields are left blank in the TA files for these latter years.

⁵Not present in MEDB or MSDB before 1979.

⁶Not present in MEDB before 1979.

⁷If course of vessel equals 360° indicating that the vessel was circling, speed of vessel is set to zero by program DREC1.

Table 2. List of data elements for which missing values are indicated by a -1.

Data element name

Number of speed boats
 Degree latitude
 Minute latitude
 Degree longitude
 Minute longitude
 Beaufort
 Bearing of cue
 Distance of cue
 Numbers of speed boats used
 Total number evaded set¹
 Number escape before rings up²
 Tons lost during backdown³
 Tons yellowfin
 Tons skipjack
 Tons other
 Malfunction delays set⁴
 Bearing of the vessel
 Speed of vessel
 Number of binoculars
 Wind tow line in

¹Not set to -1 if data element evaded set (yes/no) equals 2.

²Not set to -1 if data element escape before rings up (yes/no) equals 2.

³Not set to -1 if data element fish lost during backdown (yes/no) equals 2.

⁴Not set to -1 if data element malfunction delays set (yes/no) equals 2.

LIST OF FIGURES

- Figure 1. Diagram of the major steps in creating the TA files from the observer data bases.
- Figure 2. Flow chart of the programs and intermediate files created by the M-1 process. Boxes indicate files and elipse indicate programs.
- Figure 3. Diagrams indicating how the value of MAXD was calculated.
 P_1 = the last known position
 P_2 = the next known position
 I_p = the interpolated position
 E_b = the elapsed distance traveled between the time of P_1 and I_p
 E_a = the elapsed distance traveled between the time of P_2 and I_p
 D = the distance between P_1 and P_2
- a) for the situation in which
 $D < E_a + E_b$ and
 $E_a + D < E_b$ and
 $E_b + D > E_a$
- b) for the situation in which
 $E_a + D \leq E_b$
or
 $E_b + D \leq E_a$
- c) for the situation in which
 $D > E_a + E_b$
- Figure 4. The frequency distribution of the value of MAXD for all interpolated position estimated by the M-1 process.
A) 1977
B) 1978
C) 1979
D) 1980

Figure 1. Diagram of the major steps in creating the TA files from the observer data bases.

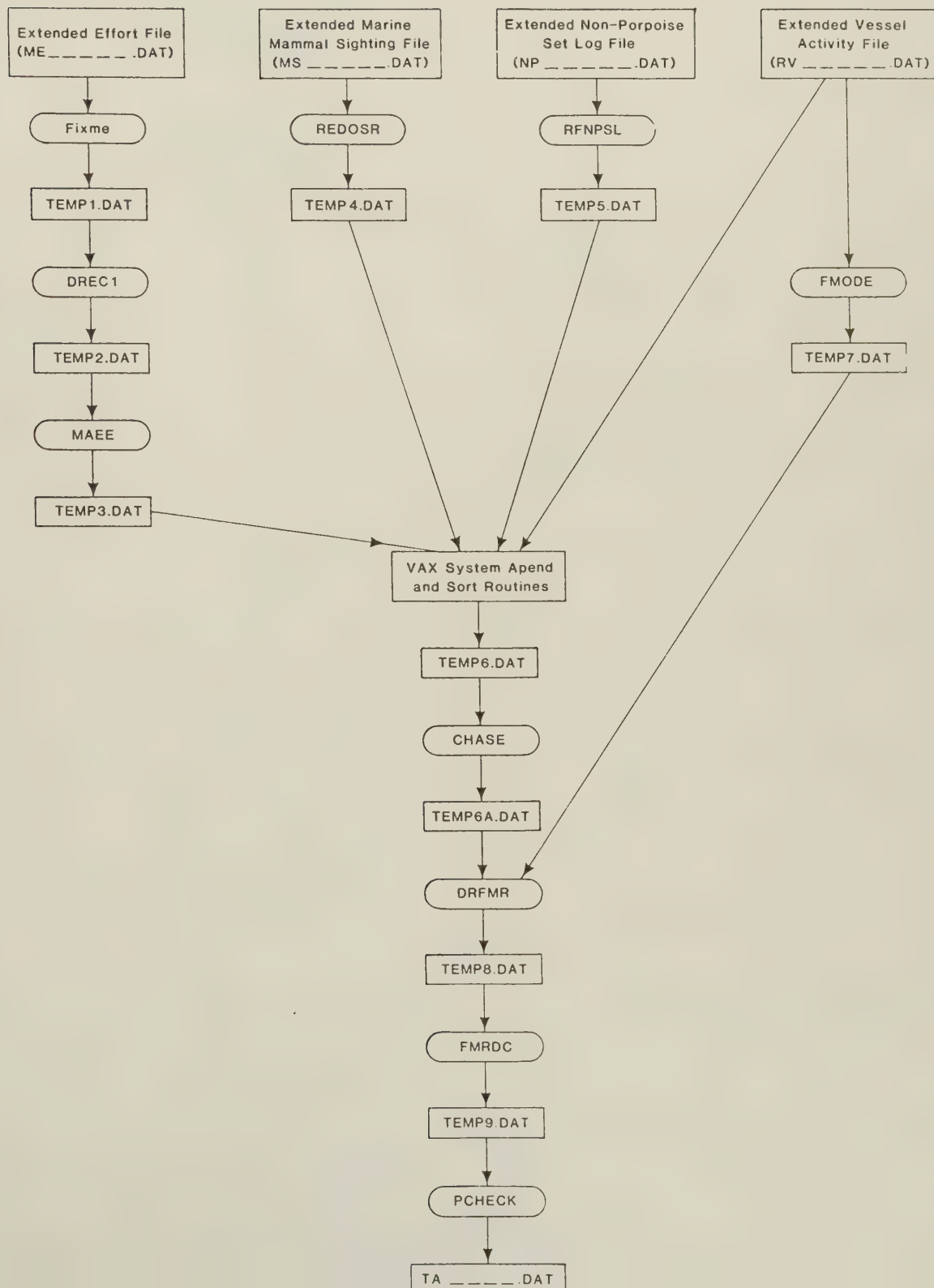


Figure 2. Flow chart of the programs and intermediate files created by the M-1 process. Boxes indicate files and elipses indicate programs.

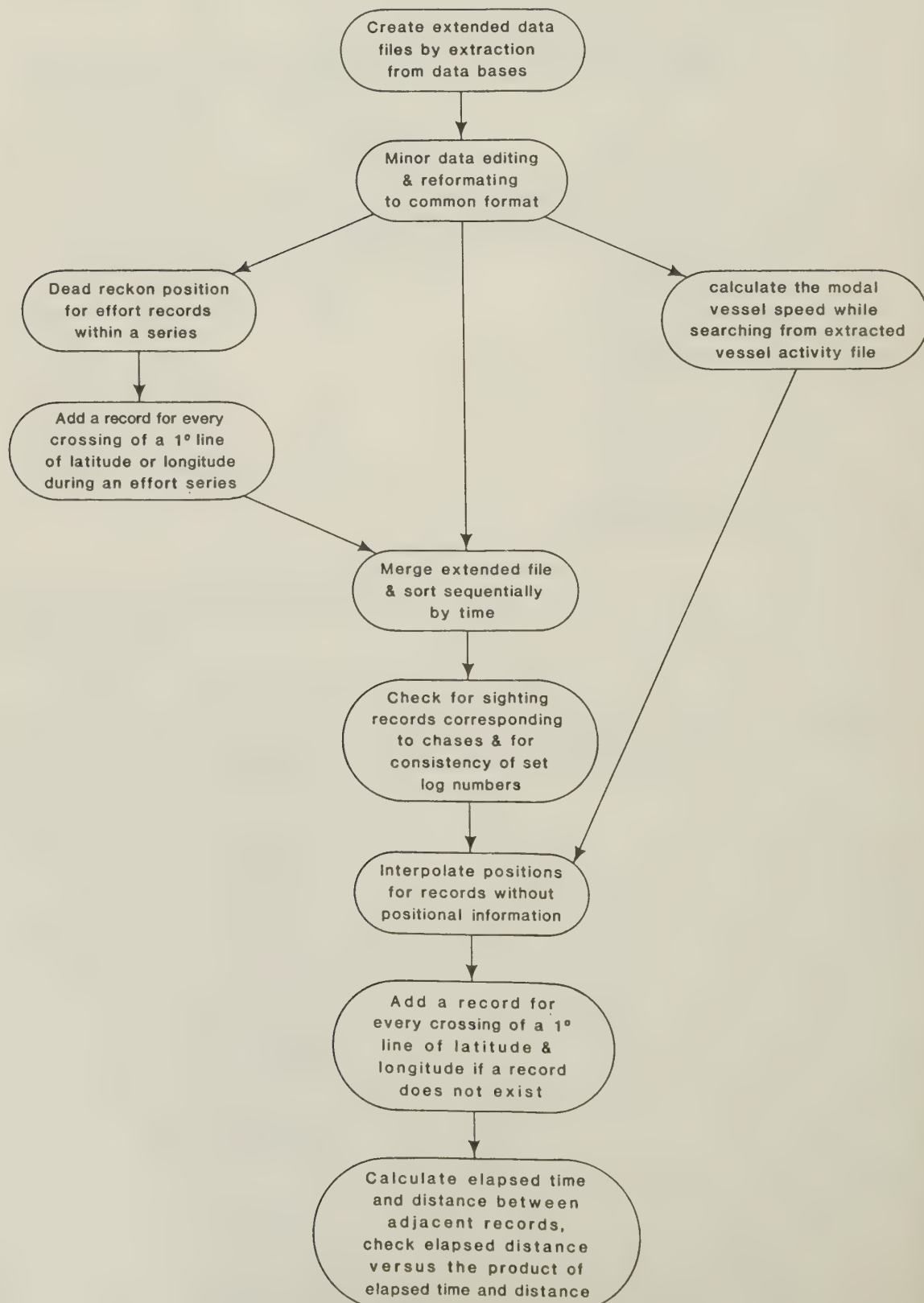
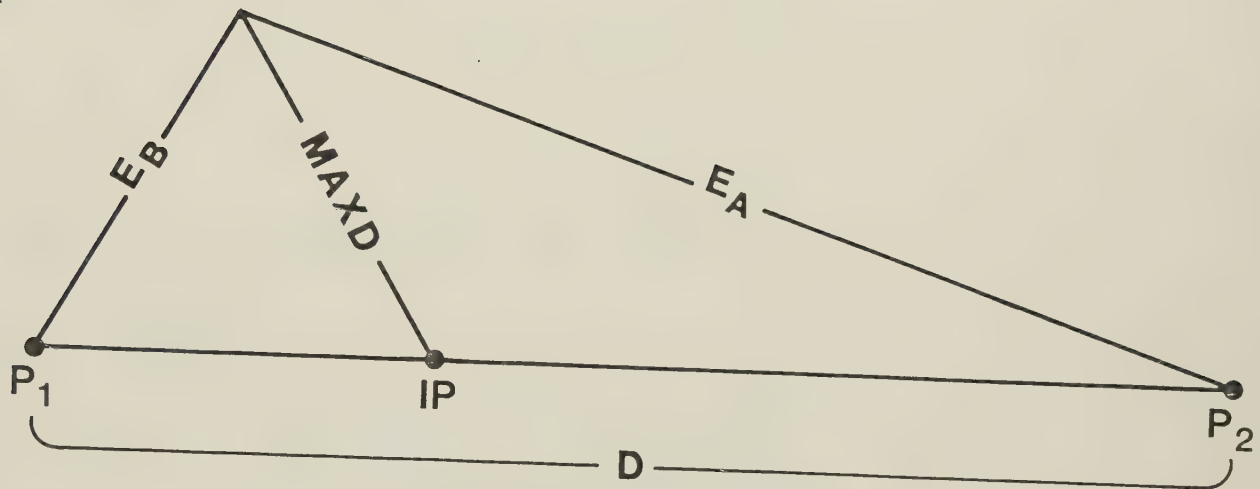
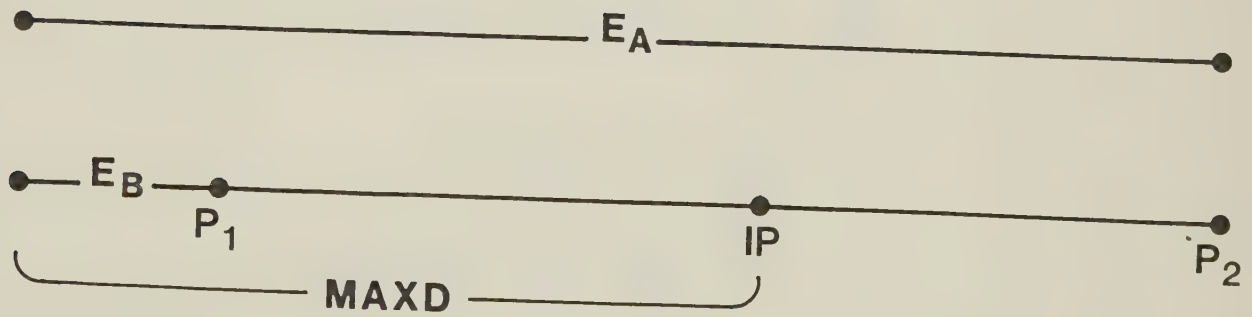


Figure 3. Diagrams indicating how the value of MAXD was calculated.

A



B



C

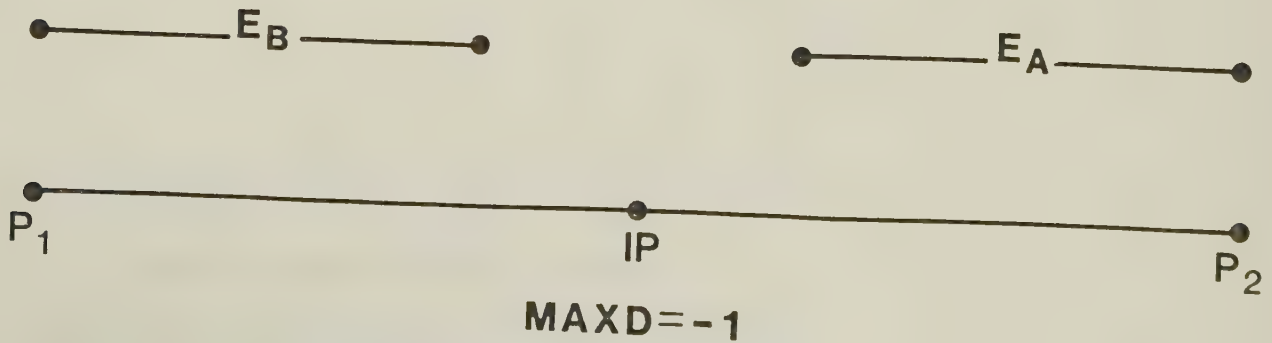
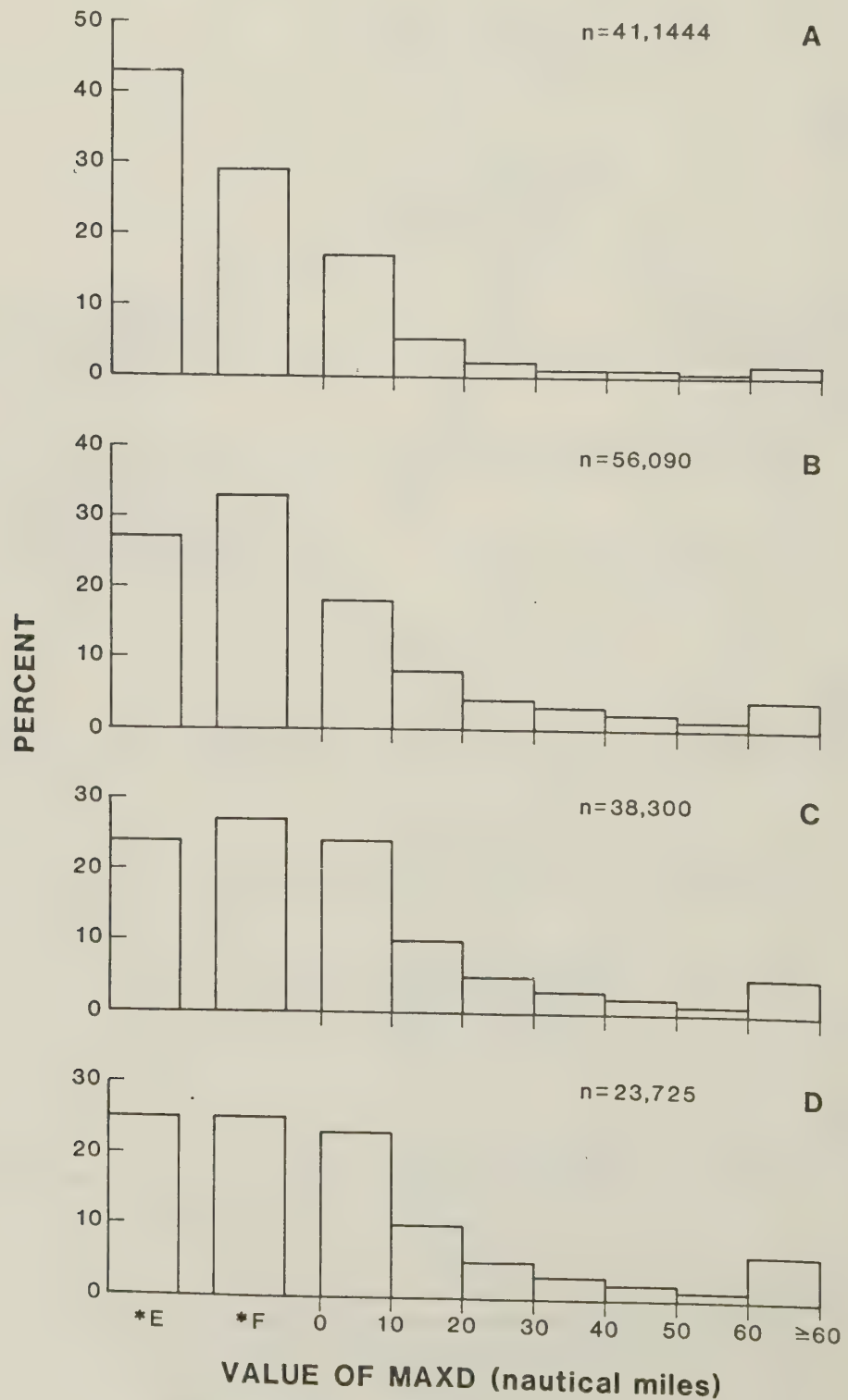


Figure 4. The frequency distribution of the value of MAXD for all interpolated positions estimated by the M-1 Process.



*E=distance traveled is less than physical distance (MAXD=-1)
 *F=distance traveled equals physical distance (MAXD=0)

APPENDIX

Code tables for coded variables
created or modified by the M-1 process.

Code Table 1 for data element name trip completed.

Value	Definition
1	Trip completed and only a single observer.
2	Trip not completed and only a single observer.
3	Trip completed with more than a single observer; one observer spent more than 80% of the trip on board.
4	Trip completed with more than a single observer; one observer spent between 50-80% of the trip on board.
5	Trip completed with more than a single observer; no one observer aboard more than 50% of the trip.
6	Trip not completed and more than a single observer; one observer aboard more than 80% of the observed portion of the trip.
7	Trip not completed and more than a single observer; one observer aboard 50 to 80% of the observed portion of the trip.
8	Trip not completed and more than a single observer, no one observer aboard more than 50% of the observed portion of the trip.

Code Table 2 for data element end leg code.

Code number	Description
1 (1974-)	End of a leg due to a change in the course of the vessel.
2 (1974-)	End of a leg due to change in the speed of the vessel.
3 (1974-1976)	End of a leg because the vessel stops the searching activity. (Should be reflected in the daily vessel activities record).
(1977-1980)	End of a leg because the vessel begins a chase or circling mode leading to a set. (Should also be reflected in the fishing mode record).
4 (1974-)	End of the leg for other reasons, e. g., meals, coffee break. etc.
5 (1974-)	End of the leg for recording a position.
6 (1979-)	End of a leg due to the helicopter landing or taking off, regardless of course and/or speed change. (Only used on vessels that have a helicopter on board).
7 (1980-)	End of a leg due to a change in sea state.
8	Indicates that record is an inserted record from program MAEE to denote the end of a series of effort.
9	Indicates a leg of effort inserted into the data file by program MAEE to denote the crossing of a 1 ⁰ line of latitude or longitude during an effort series.

Code Table 3 for data element mode.

Code number	Description
1 (1975-)	Drifting to rest, usually at night.
2 (1975-1978)	Drifting because of bad weather, during day: not at night (use 1).
3 (1975-1978)	Drifting for repairs.
6 (1975-1978)	Drifting while visiting another boat, fuel transfer, medical, etc.
7 (1975-)	In port, tied up or anchored.
8 (1976-1978) (1975 and 1979-)	End of cruise. (Completed trip.) End of cruise.
9 (1975-1978)	Drifting for other than above reasons or codes 21 or 24.
10 (1975-1978)	Running to first grounds, not searching.
11 (1975-1978) (1979-)	Running to new grounds, not searching. Running not searching.
12 (1975-1976)	Running to port, not searching.
13 (1975-1976)	Running from bad weather, not searching.
14 (1975-1976)	Running and not searching for reasons other than described above.
15 (1976-1978)	End of cruise. (Incomplete trip).
16	Vessel inactive but no inactive code given in VA data base.
17	No yes answer found for any of the questions inactive, searching, set/chase in vessel activity data base.

Code Table 3 Continued

Code number	Description
20	Vessel searching.
21 (1975-1978) (1979-1980)	Drifting or circling to watch schoolfish. Drifting and or circling to watch flotsam or schoolfish i.e. a potential target for a nonporpoise set.
22	Vessel in a set according to VA data base.
23	Vessel in a chase which did not lead to a set.
24 (1975-1978)	Drifting or circling to watch log, dead whale, or any other floating object during the day (not at night).
30	Sighting record from MSDB.
40	Effort record from MEDB.
50	Nonporpoise set log record from SLDB.

Code Table 4 for data element source of position.

Code number	Description
0	Position from MSDB (1977-1978) or SLDB (if nonsighting record).
1	(1979-1980) Dead reckoned position from MSDB.
2	(1979-1980) Verbal position from MSDB.
3	(1979-1980) Satellite position from MSDB.
4	(1979-1980) Post cruise position from MSDB.
5	Position from SLDB if record is a sighting but no position recorded in MSDB but one recorded in SLDB.
6	Position from MEDB.
7	Position generated by program DREC1.
8	Position generated by program DRFMR.
9	Position generated by the program MAEE (if mode equals 40) or by program FMRDC (if mode not equal to 40)

